BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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In the Matter of	)	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)))	FCC Docket No. ET 98-153

To: The Commission

COMMENTS OF SIRF TECHNOLOGY, INC.

SiRF Technology, Inc. ("SiRF"), pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. § 1.415), hereby responds to the Commission's solicitation of public views concerning ultra-wideband ("UWB") technology. SiRF urges the Commission to consider carefully all interference issues related to UWB before it moves forward, if appropriate, to establish any rules governing introduction of this technology.

SiRF is a leading supplier of location technology utilizing the satellite Global Positioning System "(GPS") for a wide range of mobile platforms, including automobiles, wireless handheld transceivers, portable computers and other consumer devices. Location information can be used for navigation, telematics, intelligent transportation systems, destination information access, tracking, fleet management, automatic toll billing, location-based filtering and for providing a range of other location based services. SiRF's products include chip sets, software and IP equipment, and are supported by an extensive set of development tools.

GPS is a global satellite system employing two-dozen low-Earth orbiting satellites, and designed to provide location and navigation information at any point on the surface of the Earth by taking advantage of multiple-satellite visibility. GPS devices at a given point receive multiple data streams from the satellites that contain information, such as satellite location and precise date and timing data, which allows a user to pinpoint his or her location. These signals are transmitted at very low power, such that the addition of any new, unwanted emissions into the L-band frequencies where the GPS system operates could cause rapid service degradation.

GPS has become a substantial impetus for growth in the global consumer electronics market, permitting a great variety of applications that employ precise location information. For example, GPS technology is now under active consideration as a means of meeting the FCC's mandate for wireless telecommunications services to provide accurate location information for Enhanced 911 services ("E911"). It is essential to meet the requirements of E911 that location information be very accurate and reliable. This means that GPS safety devices must be able to track the low-level satellite transmissions in wooded areas and inside buildings, among other critical locations. Any signal degradation resulting from additional noise in the GPS bands would affect the ability of the system to satisfy these requirements. Existing GPS safety-of-life services would be compromised, and this could result in loss of lives.

Some of the possible uses cited for UWB devices, such as personal computing and wireless telecommunication, would involve deployment of large numbers of pulse transmitters over wide areas – just as GPS devices are widely dispersed. This type of usage would cause UWB and GPS devices to be brought into close proximity in a wide variety of situations that are difficult to predict. As demonstrated in the attached preliminary technical analysis, operation of UWB devices across the GPS bands could cause serious interference with normal GPS operation. *See* Attached Technical Memorandum.

In light of these preliminary data, the Commission should proceed with caution as it seeks to gain greater understanding of the potential uses and hidden pitfalls of UWB technology. While the Commission's establishment of an October 30, 2000 deadline for submission of UWB test results is a first step toward facilitating the necessary understanding, SiRF is concerned at the Commission's evident interest in moving forward to establish rules based upon only a single round of data gathering. SiRF expects that, in addition to answering some of the current questions about the interference environment presented by UWB, the initial data will present additional questions that require further consideration. The Commission should ensure that it provides for such additional trials before it proceeds to finalize any rules for UWB technology.

In the interim, the Commission should refrain from granting any additional waivers that would permit operation in the GPS frequency bands, and should not adopt any provisional rules prior to the completion of thorough testing. Through decades of careful deliberation and thoughtful management, the Commission has developed a comprehensive paradigm for use of the radio frequency spectrum. UWB could augment this carefully developed system of allotments, but only if it is thoroughly tested in advance of deployment and each specific application is proven to be compatible with existing service. Permitting UWB devices to use the spectrum before adequate technical research is conducted could adversely impact the existing regulatory framework, as well as public confidence in both FCC stewardship of the spectrum and in the potential of UWB technology itself.

Respectfully submitted,

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EXAMPLE OF UWB INTERFERENCE INTO A GPS RECEIVER

A Ultra-Wideband radio demonstration by Time Domain has the system parameters[1]

Power = 1.8 mW
RF bandwidth = 1.3 GHz at 1.7 GHz
Data rate = 32 Kbps
Range > 900 meters

To check this claimed UWB performance, the free-space ($1/r^2$) propagation loss = 37 + 20log1700 + 20log(900/1609) = 96.6 dB for 0-dB gain antennas, so received power = 2.6 dBm – 96.6 dB = -94 dBm. To transmit at 32 Kbps data rate, we need C/N_o = 55 dB-Hz for uncoded BPSK with E_b/N_o = 10 dB, or a received average power of –170 dBm/Hz +55 dB-Hz = -115 dBm assuming a receiver noise figure of 4 dB. This indicates 21 dB of theoretical margin for excess propagation loss or other system imperfections, such as multipath, correlation loss, multiple-access interference, and a less efficient data modulation format. I have interpreted 1.8 mW as the average transmitted power. If the UWB transmitter is constrained to a peak power of 1 W, the duty factor is 0.018 to get 1.8 mW of average power.

Now consider interference from this UWB transmitter into a GPS receiver at a distance R in meters. Propagation loss = 37 +20log1575 + 20log(R/1609) = 36.8 +20logR. Assume the interference power in the GPS receiver is filtered by the bandwidth ratio 10MHz/1.7 GHz. Then, the power in the GPS receiver, yielding 2.6 dBm – 22.3 dB –36.8 – 20logR = -56.5 dBm – 20logR. Recent measurements by Amin Salkhi show a tolerable inband interference of -109.7 dBm of CW power to degrade operation at C/N_o = 36 dB-Hz in the GPS receiver by 1 dB. Thus, for this condition and assuming 0 dB GPS antenna gain, we require –56.5 dBm – 20logR < -109.7 dBm, or R > 457 meters to avoid excessive degradation of the GPS receiver.

Since the UWB transmitter is pulsed rather than CW, the above computation of minimum range from the UWB transmitter is pessimistic. But Reference 1 proposes a pulse width somewhat less than 1 nsec and a pulse repetition interval between 25 and 1000 nsec. Assume 100 nsec, or a PRF of 10 MHz. Then, the GPS receiver bandwidth causes the UWB pulses to overlap in time and become like random noise. The UWB signal will cause 1 dB degradation if its noiselike power within the 10 MHz GPS receiver bandwidth = –106 dBm, again assuming –170 dBm/Hz, which is not that much different from Amin's CW result.

The above computation suggests plenty to worry about regarding the likelihood of excessive interference into a GPS receiver from a large-scale deployment of a UWB system with typical transmitter parameters as assumed above. This indicates need to reduce the average UWB power, probably by reducing the duty factor, which confines the UWB system to relatively short propagation ranges. Alternatively, require the UWB transmitter to filter out 20 MHz of bandwidth at GPS L1.

REFERENCE

1. A. Petroff and P. Withington, Time Modulated Ultra-Wideband (TM-Q\UWB) Overview, Time Domain Corporation, Wireless Symposium, San Jose, Feb 25, 2000.